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Reprint from the Journal of the American Association of Instructors and Investigators In Poultry Husbandry Vol. VIII No. 1, October, 1920.

The Treatment and Prevention of Chicken Pox of Fowls

(Contagious Epithelioma)

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THE TREATMENT AND PREVENTION OF CHICKEN-POX OF FOWLS

(Contagious Epithelioma)

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The relationship between the various pathological conditions of the head of domesticated fowls has been the subject of much controversy. These conditions are variously designated as chicken pox, contagious epithelioma, avian diphtheria, canker, colds, contagious catarrh, swelled-head, roup, etc. Ward and Gallagher[1] in their recently published work, "Diseases of Domesticated Birds," express the opinion that all of these conditions are due to the same etiological factor, namely, "the filterable virus of chicken-pox or contagious epithelioma." The results of extensive study of these diseases at the California Agricultural Experiment Station, however, have led us to the conclusion that, as they occur in California, there is a distinct difference between some of them.

Classification of Diseases Involving the Skin or Mucous Membrane of the Head:—In order that there may be no misunderstanding of the nomenclature of lesions or diseases used in this discussion, I will give briefly our conception of them. **Chicken-pox or contagious epithelioma** is a readily transmissible disease manifested by the formation of small, wart-like epithelial tumors on the comb, wattles, or skin of the head. The sole causative factor of this disease is accepted to be the filterable virus of contagious epithelioma. **Canker or avian diphtheria** is manifested by formation of masses of adherent, cheesy exudate on the mucous membrane of the mouth or eyes. These diphtheritic lesions should not be regarded as evidence of a specific infectious disease, since factor other than the filterable virus of contagious epithelioma are known to sometimes produce them. **Colds, catarrh and roup** are manifested by a viscid discharge from one or both nostrils, which has a tendency to collect in the nasal sinuses where it undergoes rapid transformation into a cheesy mass causing marked swelling of the face beneath the eyes. Such lesions, as in the case of canker, are believed to be due to a variety of causes.

There is abundant evidence, both clinical and experimental, to indicate that chicken pox and the most common form of canker are due to the same causative factor. Diphtheritic lesions or canker in the mouth or eyes can be produced by intravenous or subcutaneous inoculation with a suspension of finely ground chicken-pox virus derived from scabs removed from the tumors on the skin of diseased birds, or by applying the virus to a scratched surface on the comb. In like manner, typical chicken-pox lesions may be produced by inoculation of the comb with material from mucous membrane lesions. A vaccine prepared from dessicated chicken-pox scabs affords protection against canker as well as chicken-pox. In outbreaks of chicken-pox, the number of affected fowls with canker of the mouth or eyes only may be as high as sixty per cent.

However, as above stated not all cases of canker can be regarded as due to chicken-pox virus. We recognize three distinct forms which for convenience we classify as **chicken-pox canker, mechanical canker, and malignant canker. Mechanical** canker is produced by injury to the mucous membrane. It commonly occurs in the cleft in the hard palate and inner corner of the eye as a result of a particle of litter or kernel of grain becoming lodged there. Removal of the cause results in prompt recovery. **Malignant canker** is so classified on account of its nature. It commonly occurs on the base of the tongue or the side of the larynx, penetrates deeply into the tissue, does not respond to any treatment so far attempted, is accompanied by general symptoms such as depression, loss of appetite, and rapid emaciation, and practically always terminates fatally. All attempts to determine the cause have thus far been unsuccessful. However, since it is of rather rare occurrence and has shown no tendency to spread from diseased to healthy fowls in the same flock, it is not yet of much economic importance. Since chicken-pox is the subject to be discussed, when the term "canker" is used hereafter in this paper it will refer only to "chicken-pox canker".

We have found little to indicate that there is any relationship between chicken-pox and roup, but instead, considerable evidence that they are not, as a rule, in any way related. A nasal discharge is so infreqnently associated with canker, especially in the early stages, that it would seem there is little ground for considering this an indication of chicken-pox or canker when it does occur. Even in very severe advanced stages of canker, the nasal passages are not necessarily involved. On the other hand, it is extremely rare to find canker of the eyes or mouth accompanying roup. Even though the sinuses may be so distended as to cause the eyes to become closed, as a rule, no cheesy material is formed in them. It is a well established fact, that birds that have recovered from chicken-pox are immune to the disease. It has been frequently observed however, that birds that have had chicken-pox are not rendered immune to roup, nor that birds that have had roup are immunized against chicken-pox. It is very probable that there are always a few cases of roup present in all large flocks no matter how well they may be housed and cared for, but we have yet to observe an epidemic of roup in any flock in California, that was given proper care. Chicken-pox and canker are just as liable to attack a well cared for flock as one poorly cared for. Therefore, we do not consider roup to be related to chicken-pox, to be a specific infectious disease nor a menace to successful poultry raising.

A Malnutritional Disease Resembling Roup:—There has occurred during the last year epidemics of a disease involving the mucous membrane of the mouth, pharynx, eyes, and the nasal passages which closely simulates roup, but which has been found to be entirely distinct. In the mouth and pharynx we find pustule-like caseous patches 1 to 2 mm. in diameter. On pressure, we find that the caseous material penetrates quite deeply into the mucosa. These may be so numerous as to give the mucosa, especially of the pharynx, the appearance of being covered with caseous false membrane. These pustules are often found in the mucosa of the esophagus as far as the proventriculus. We also frequently find the cleft in the hard palate and the glottis filled with caseous exudate. In the eyes we find first a thin, viscid discharge which may glue the eyelids together, then the formation of a tightly adherent white membraneous film over the third eyelid, and finally the collection within the eyelids of a mass of white cheesy exudate. There is usualy a clear, viscid discharge from one or both nostrils which later may become turbid and flocculent, and be followed by swelling of the nasal sinuses. On post-mortem examination of dead birds, we usually find the kidneys severely involved. They are usually very pale and marked with a network of very fine white lines which are urate filled tubules. We also frequently find a deposit of white material, probably urates, on the liver, heart, and other organs. The results of our study of this disease have led to the belief that although it frequently affects large numbers in the same flock, it is not of an infectious nature, but rather due to some nutritional disturbance. This belief was arrived at after failure to transmit the disease from diseased to healthy birds or to find any species of bacteria which appeared to be a causative factor and success in controlling and reproducing the disease by certain methods of feeding. This disease is always mistaken for roup by poultrymen, and it is very possible, that many so-called "outbreaks of roup" have in reality been this nutritional disease.

Treatment of Chicken-pox:—In the treatment of chicken-pox and canker, we have found that the administration of chicken-pox vaccine is a valuable adjunct to other remedial measures. The scabs from the pox tumors and caseous exudate from the mouth or eyes are removed with forceps. Tincture of iodine is then applied with a medicine dropper. This treatment is repeated at two or three day intervals as long as necessary. Except in very severe cases not more than two or three treatments are necessary. In addition, two or more 1 or 2 mil doses of chicken-pox vaccine at three to five day intervals are given. In experiments to determine the curative value of chicken-pox vaccine, five hundred and thirty-six diseased fowls were used. They were divided into two lots of two hundred and sixty-eight each. In order that there might be a nearly equal number of fowls in each lot with lesions of the same type and degree of severity, the location and severity of the lesions were the basis upon which the selection of the birds for each lot was made. Each bird in one lot was given two 1 mil doses of vaccine in addition to local treatment of the lesions, while the birds in the other lot received local treatment of the lesions only. The percentage of mortality of fowls in the lot receiving vaccine was 19.6, and of those in the lot not vaccinated 38.9. The average number of days required for recovery of the fowls vaccinated was 10.8, of those not vaccinated 13.7. From these results it would appear that the use of vaccine that is of considerable value in the treatment of chicken-pox and canker.

Prevention by Vaccination:—It is for prevention rather than cure, however, that chicken-pox vaccine is designed and chiefly used. The first vaccine experiments in California were made in 1914. The results obtained were so satisfactory that the vaccine was recommended for use to commercial poultrymen. It was only natural that at first many poultrymen were skeptical of the value of vaccination. Continued good results however soon dispelled this skepticism and at present in California the use of chicken-pox vaccine by poultrymen is as general as the use of blackleg and anthrax vaccine by cattle raisers in infected districts. During the fiscal year ending June 30, 1920 the California Agricultural Experiment Station furnished vaccine for over 300,000 birds.

Propagation of the Virus:—The method used in preparing vaccine is a development of that used by Manteufel[2] in 1909 and Hadley and Beach[3] in 1912-13. Scabs removed from chicken-pox lesions are the source of virus used in preparing vaccine. The virus is propagated by inoculating the combs of healthy cockerels with a suspension, in sterile water, of dried ground scabs. Only scabs from the comb are used, any lesions developing upon the mucous membranes being discarded. The inoculation is made by moistening one side of the comb with the suspension of ground scabs then vigorously scarifying the entire surface with a large dull hypodermic needle or other instrument, and then moistening the scarified surface with the suspension of scabs. This process is repeated on the other side of the comb. Care is taken that none of the virus comes in contact with the mucous membrane of the eye. Lesions appear in five to seven days and develop sufficiently to permit the removal of scabs in two to three weeks. A second

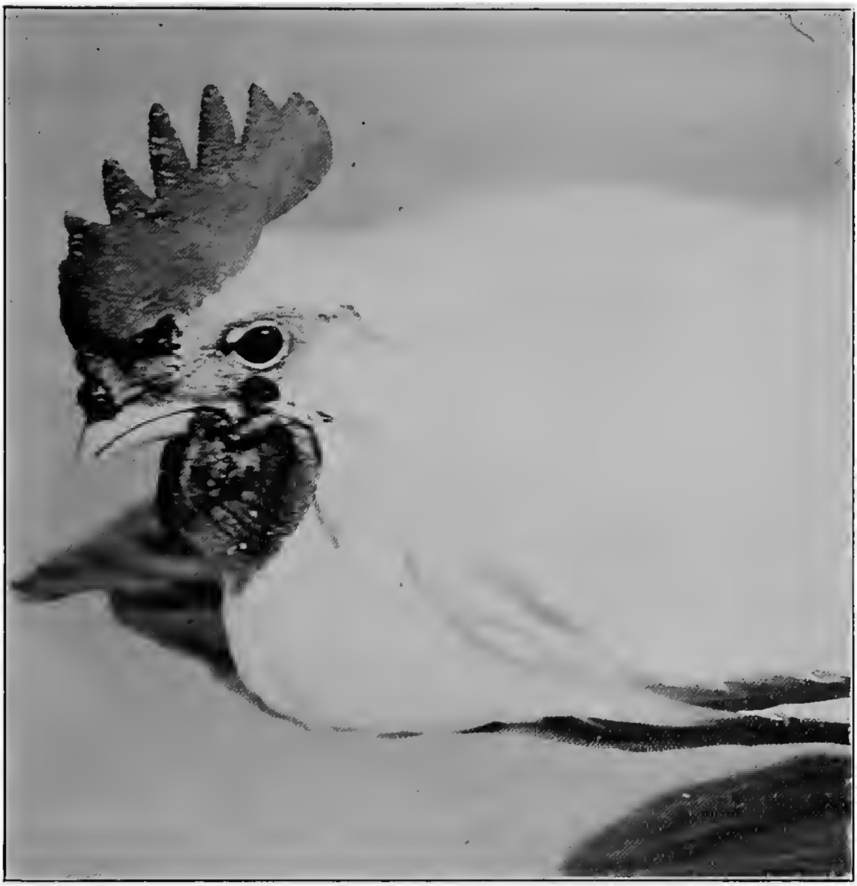

Fig. 1. Chicken-pox—on cockerel—Natural Infection.

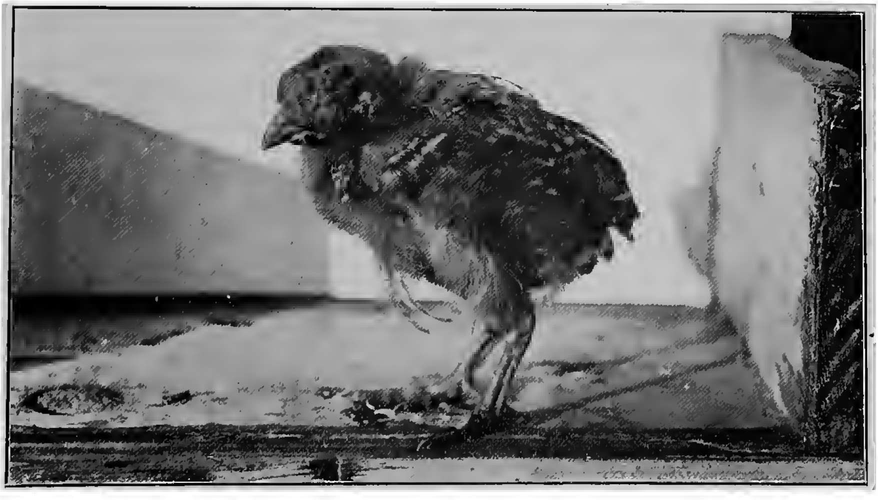

Fig. 2. Chicken-pox—Baby Chick—Natural Infection.

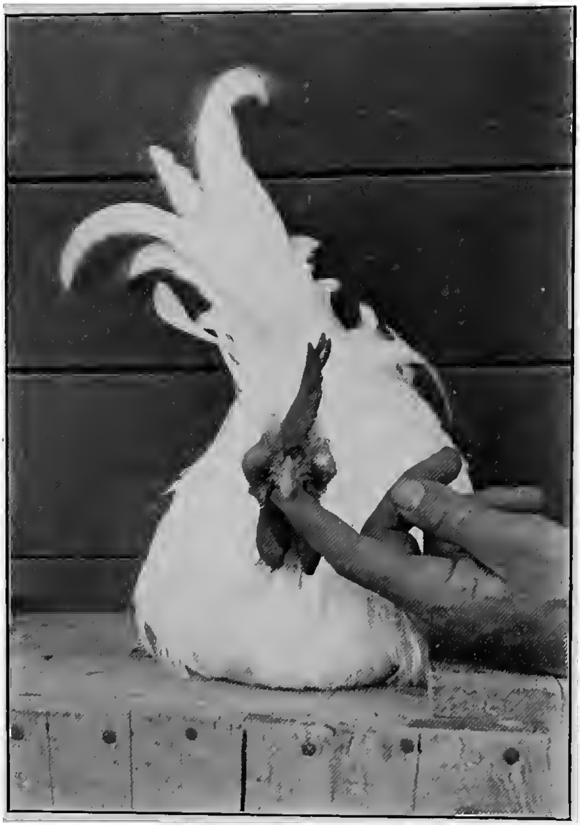

Fig 3. Canker-Eye—from Natural Infection with Chicken-pox Virus.

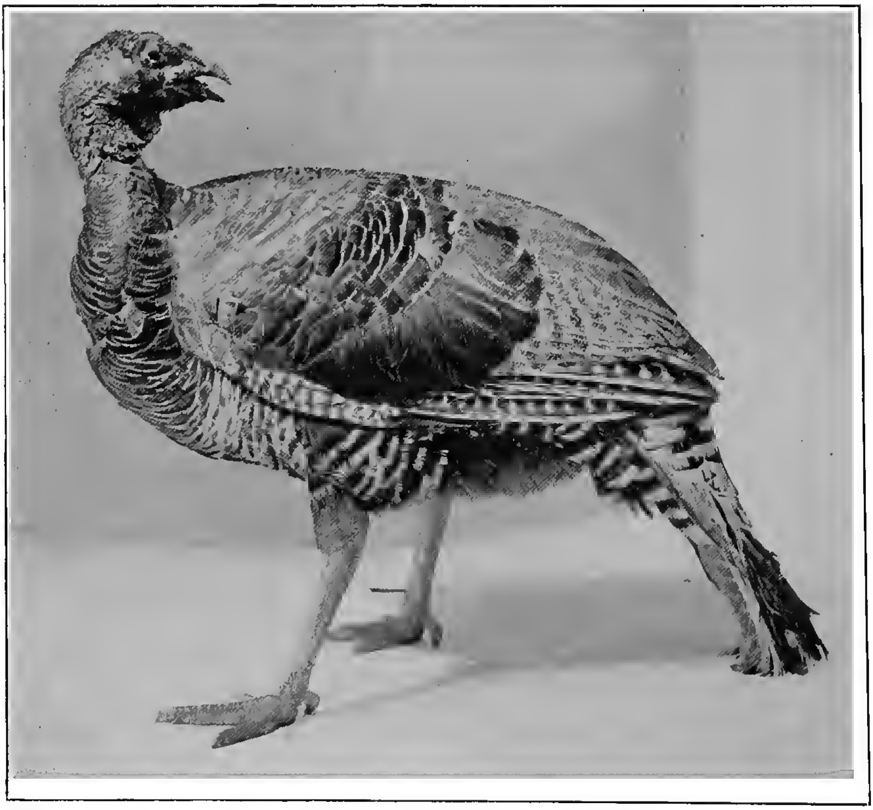

Fig. 4. Pox on Turkey——— ———

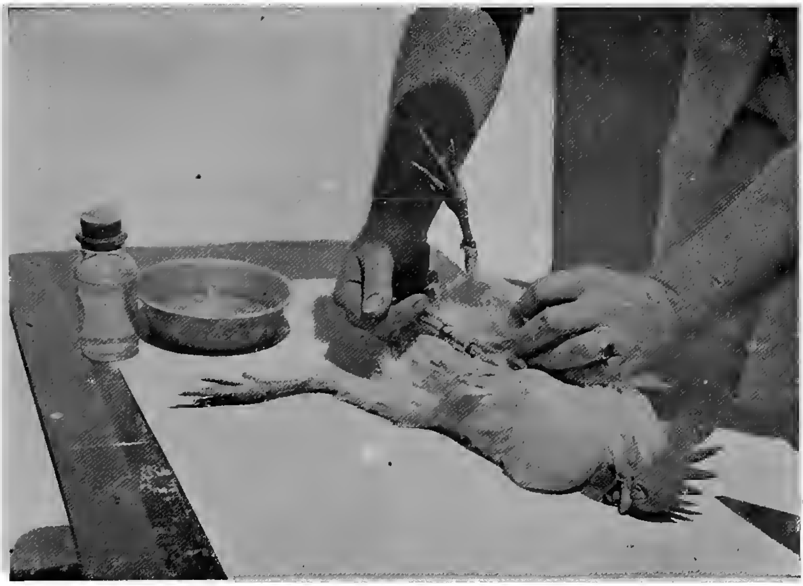

Fig. 5. This figure shows the method of holding a fowl and administering chicken-pox vaccine.

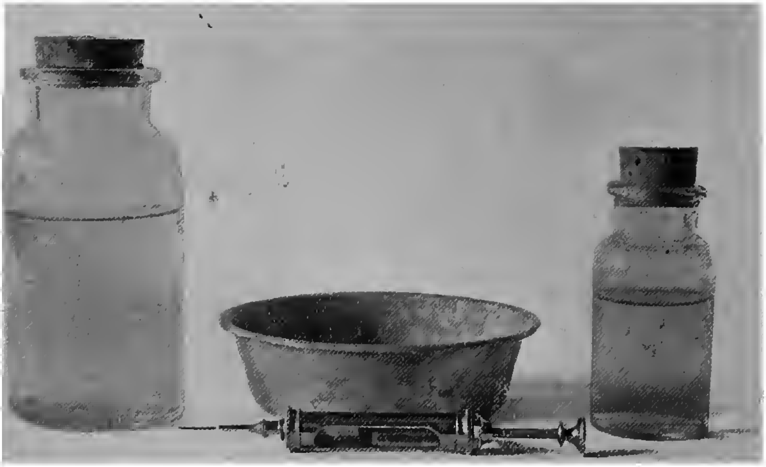

Fig. 6. Apparatus required for vaccination: 1. Large bottle of vaccine. 2. Pan of disinfectant for cleansing the skin at the point of injection. 3. Hypodemic syringe. The syringe shown is of 6 cc. capacity and provided with a burr on the plunger to regulate the dose. 4. Small bottle of vaccine from which the syringe is filled.

growth of scabs can be removed seven to ten days later. The percentage of mortality of the inoculated birds ranges from fifty to one hundred per cent, the greatest loss usually occurring soon after the first growth of scabs is removed. After removal, the scabs are thoroughly dried and reduced to a fine powder by grinding in a small coffee mill, and then in a ball mill for twenty-four to forty-eight hours. This powdered virus if perfectly dry, will keep for months and may be stored in sterile bottles until needed in preparing vaccine. High potency of the virus is maintained by keeping fowls constantly inoculated and using for inoculation purposes fresh dried scabs from severe cases, and by occasionally securing new strains of virus from naturally infected birds.

Method of Preparing Vaccine:—One gram of the powdered dessicated virus to 100 mils of physiological salt solution is the proportion used in making vaccine. This proportion was adopted after making numerous trials with varying amounts of virus. Aseptic precautions are observed. The virus is first weighed out and placed in a sterile mortar with a sufficient amount of sterile salt solution to make a paste, and ground for at least five minutes or until the mixture acquires a smooth cream-like consistency. Four or five mils of sterile salt solution to each gram of virus is required for this purpose. To this mixture is then added sufficient sterile salt solution to bring the volume up to 80 mils. It is then poured into a sterile flask or bottle, placed in a water bath and heated at a constant temperature of 55° C for an hour. It is then filtered through sterile cheese cloth into a sterile flask or bottle and to it is added 20 mils of sterile salt solution containing 1 per cent of tricresol which mixture is poured through the filter so as to wash out as much of the pulversized material as possible. After cooling in running water or ice water until the temperature is below 7° C the vaccine is ready for transfer to the ultimate containers which are sterile bottles of amber or other dark glass. The vaccine may retain its potency for more than a month after preparation and on the other hand it may become less effective within two weeks. Therefore vaccine should be used as soon after preparation as possible.

Efforts to Standardize the Vaccine:— Our experiments have shown that the immunizing value of vaccine varies directly as the virulence of the virus contained therein. Since there is a variance in the virulence of different lots of virus there is necessarily a variance between different lots of vaccine. Thus far all attempts to devise a method of standardizing the virus in vaccine have proved unsuccessful. These have included the complement fixation test, inoculation of fowls with vaccine by scarification of the comb, and the intracutaneous injection of vaccine. The complement fixation test proved to be entirely inapplicable. Vaccine capable of producing marked lesions on fowls inoculated by scarification of the comb produced a higher degree of immunity in fowls vaccinated than vaccine capable of producing only mild lesions. At present, however, it is not possible to determine, by observing the lesions produced on fowls inoculated with vaccine, the degree of immunity it may be expected to produce in fowls vaccinated. The intracutaneous injection of vaccine gave no determinative reaction.

Efforts to Improve the Vaccine:— Various attempts were also made to increase the efficiency of the vaccine by improving upon the method of preparation. The use of glycerine in the preparation of vaccine did not produce a more satisfactory product. Vaccine prepared in the usual manner, but not heated, proved to be an efficient immunizing agent, but it also produced disease in more than fifty per cent of fowls vaccinated. For this reason such vaccine cannot be used. A shake-extract of powdered virus was found to be an efficient immunizing agent when fresh, but it did not retain this property sufficiently long to make such a lengthy method of preparation practical. Powdered virus made in the form of "pills" and given subcutaneously conferred no immunity. The intracutaneous injection in the wattle of 1/10 mil doses of regular or shake extract vaccine proved to be a very efficient means of immunization. However, the development of lesions at the injection point and elsewhere about the head, and areas of induration at the point in the wattle make this method both dangerous and objectionable.

Method of Administration:—The vaccine is adminstered subcutaneously. The dose is one mil for each bird. The most convenient place for administration is beneath the skin of the breast under the right thigh, the skin at that point being comparatively free from feathers. Special precautions must be taken that the vaccine is injected **just beneath the skin not into the breast muscle.** The bird may be held either by the operator or by an assistant. **When the operator holds the bird,** the left wing is held back, the fowl is laid on its left side, and the right wing and leg and feathers held back with the last three fingers of the left hand. The exposed skin is then cleansed with a piece of cotton saturated with disinfectant solution (2 per cent solution of compound solution of cresol) and picked up with the thumb and forefinger of the left hand. Then with the right hand the syringe needle is inserted just **beneath the skin** and the proper dose injected. With a little practice one man with an assistant to catch the birds can vaccinate from 100 to 150 per hour.

When an assistant holds the bird, both wings are grasped with the left hand and both legs with the right hand. The bird is then laid on its left side with the breast toward the operator. The operator standing a little to the rear of the bird, cleanses the skin at point of injection, picks it up with the thumb and forefinger of the left hand, and with the right hand inserts the syringe needle just **beneath the skin** and injects the vaccine. By this method a man with two assistants to catch and hold the birds can vaccinate from 200 to 300 per hour.

A syringe of six to twelve mils capacity is well suited for this work. The needle should be 16 to 18 gauge and from 1½ to 2 inches over all in length. A screw needle is preferable.

One treatment is usually sufficient in healthy or slightly infected flocks. In badly infected flocks a second treatment for all birds is advised. In very severe outbreaks the injections should be continued at intervals of 5 to 7 days until the disease ceases to spread.

Effect of Vaccination on the Fowls:—Chicken-pox vaccine if properly administered never has any harmful effect. We have occasionally observed a slight depression following vaccination which lasted for one or two hours, but as a rule there is no reaction. The vaccine has no harmful effect on the growth or development of growing stock and therefore it can be safely used on birds of any age. Vaccination does not influence egg production. There may be a slight decrease in egg yield following vaccination, but this is no greater than would result if the fowls were handled for any other purpose. Therefore there need be no hesitancy about vaccinating a heavy producing flock.

The Protective Value of Chicken Pox Vaccine:—We have found that partial or nearly complete protection against severe artificial infection with chicken-pox virus may develop in two to six weeks after vaccination. Some lots of vaccine afford nearly complete protection while with other lots the protection is less marked, and with still other lots very slight. The amount of protection afforded was measured in all cases by comparing any lesions on vaccinated birds produced by the inoculation with those produced on an equal number of non-vaccinated control birds inoculated with the same virus. This variation in the protection afforded by different lots of vaccine is explained by the previously mentioned variation in virulence of different lots of virus.

It would seem very probable however that the resistance to artificial infection produced by the vaccine, is sufficient to protect against natural infection which could not be as severe as the artificial infection. A series of experiments were conducted in which an aggregate of twelve hundred and ninety-eight birds were used, two hundred and seventy-two of which were naturally infected with chicken pox. Nine hundred healthy fowls were vaccinated and one hundred and twenty-six healthy fowls were not vaccinated. None of the diseased fowls were removed from the flocks after vaccination; thus affording every opportunity for the then healthy fowls to become infected. It was positively known that none of the healthy fowls had been previously infected with chicken-pox. All fowls were leg banded and therefore an accurate record of the condition of each fowl could be kept. Frequent examination of each fowl showed the following; of the vaccinated healthy fowls eleven per cent subsequently became diseased. Such results seem to us exceedingly good evidence of the protective value of chicken-pox vaccine against natural infection.

The results of experiments to determine the length of the immunity have indicated that it may vary from nine months to more than two years. Field observations show however, that the immunity may last no longer than two or three months. On account of the uncertainty in regard to the longevity of the immunity produced, it is recommended that flocks be vaccinated only to prevent the spread of infection already present and not for the purpose of immunizing them against subsequent infection.

Conclusions:—In concluding this discussion it is desired to emphasize the following points:

1. As they exist in California, there does not appear to be any etiological relationship between chicken-pox and those pathological conditions of the nasal passages commonly designated as colds, roup, or swelled-head.
2. Many so-called "outbreaks of roup" may in reality be a disease manifested by symptoms very similar to roup, but due to nutritional factors.
3. There appears to be ample evidence that chicken-pox and those pathological conditions of the mucous membranes of the mouth and eyes commonly designated as canker or avian diphtheria are etiologically identical.
4. Vaccine prepared from dessicated chicken-pox virus while not conferring, in the majority of cases, complete protection against severe artificial infection does confer a considerable degree of resistance. This is shown by the mildness of lesions produced by inoculating vaccinated birds with virus as compared with those produced by inoculating non-vaccinated control birds.
5. Chicken-pox vaccine has proved to have considerable curative value when used on diseased birds.
6. Chicken-pox vaccine has proved a very effective means of promptly checking outbreaks of chicken-pox and canker. The use of this product has become very general among poultrymen of California.
7. The length of immunity produced by chicken-pox vaccine may vary from two months to more than two years. For this reason, the vaccine is recommended only to check the spread of the disease in flocks already infected.
8. The efficiency of chicken-pox vaccine is dependent upon the degree of virulence of the virus contained in it. Since there is considerable variation in the virulence of different lots of virus and there is at present no method of standardizing the virulence of virus, there is necessarily considerable variation in different lots of vaccine.
9. It is realized that the present method of preparing chicken-pox is very imperfect. Thus far, however, all efforts to devise a better method have proved failures.

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[1] Ward and Gallagher, Diseases of Domesticated Birds. The MacMillan Co., 1920.

[2] Manteufel, Arb. d. Kaiserl Gensudh XXXIII (1910) 305.

[3] Hadley and Beach, Proc. Am. Vet. Assn. 1913, p. 704.

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